REMARKS

Claims 1, 3-6, 9-11, 14-17 and 20-25 are pending in this application, all of which have been rejected.

The Rejections Based Upon Prior Art

1. Claims 1-6, 9, 11, 13-17 and 20 are rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,439,668 (hereinafter, "Hagenbuch et al."). Hagenbuch et al. is directed to a top-dumping container handler and discloses a vehicle for receiving, carrying, and dumping at least one container. The container handler has a frame with an attached support structure. At least one container cradle for receiving and holding the container is supported by the support structure for movement between a centered position and at least one dumping position. A locking assembly engages a corresponding locking slot on the container to prevent shifting or movement of the container relative to the cradle. A dumping assembly moves the container cradle between the centered position and the dumping position.

Independent claim 1 is amended herein to substantially include the recitations of claim 2 and is submitted to be allowable over Hagenbuch et al. In particular, claim 1 now recites, *inter alia*, that the 4-bar linkage provides a compound motion of the pallet hopper characterized by a nearly vertical movement of the forward edge of the pallet hopper as the pallet hopper transitions from the pallet loading and stacking position to the stacked pallet discharge position.

This motion is clearly illustrated in Figs. 2A to 2E of Applicant's drawings and explained at page 8, line 12 to page 9, line 10. As can be seen, leading edge 44 of the pallet hopper remains

substantially within a vertical line of movement from Fig. 2A (loading and stacking position) to Fig. 2E (discharge position).

Hagenbuch et al. does not disclose or suggest this feature of Applicant's invention. As can be seen from Figs. 23 to 26 of Hagenbuch et al., the cradle 122 moves in an arcuate trajectory from the loading to the dumping positions.

While it is true that Hagenbuch et al. provides a 4-bar linkage, not all 4-bar linkages are the same. The Examiner's attention is drawn to Exhibits 1 and 2 appended hereto which is are articles explaining various types of 4-bar linkages.

Applicant's pallet hopper and 4-bar linkage are configured and dimensioned such that the lending edge 44 serves as a moving axis around which the pallet hopper pivots, wherein the movement of the leading edge is substantially linear and vertical. In contrast to this, the movement of the Hagenbuch et al. cradle leading edge is clearly arcuate. And as can be seen from Figs. 23 to 26, the configuration of the links 184 and 186 is significantly different from the links 30 and 31 of Applicant's apparatus.

It is respectfully submitted that Hagenbuch et al. neither discloses nor suggests Applicant's invention as recited in claim 1. Accordingly, claim 1 and all claims depending therefrom are submitted to be allowable over Hagenbuch et al. Reconsideration and withdrawal of the rejection are respectfully requested.

However, Applicant respectfully also submits that the dependent claims discussed below are further distinguished over Hagenbuch et al. and are separately patentable.

With specific reference also to claim 3, the cradle 122 of the Hagenbuch et al. apparatus is not disclosed as being oriented at a slight downhill incline relative to the horizontal when in a loading position. The slight downhill incline of Applicant's hopper facilitates manual loading and stacking of the pallets one at a time by a workman from the side of the apparatus. The Hagenbuch et al. cradle 122 is adapted for holding a container in an upright position while loading the container from the top. There is no reason for one skilled in the art to modify Hagenbuch et al., which is intended to hold large containers for loading, by incorporating a feature adapted to facilitate loading of pallets one at a time by a worker.

Claims 5 and 15 recite that the distances between consecutive pivot points on each side of the pallet hopper are substantially equal. This feature is neither disclosed nor suggested by Hagenbuch et al.

Claims 6 and 17 recite, inter alia, that the pallet hopper possesses at least one flow track to facilitate discharge of stacked pallets when the pallet hopper is in the discharging position. See, e.g., Applicant's Fig. 1B, flow track 56. Hagenbuch et al. possess no flow track. The container 30 is fixed to the cradle and the contents of the container are dumped by inverting the container.

Regarding claim 11, Hagenbuch et al. neither discloses nor suggests anything like the stacked pallet staging unit 100 of Applicant's invention. It is into this staging unit that the stacked pallets are discharged from the hopper. Hagenbuch et al. is not directed to the discharge of pallets but the dumping of bulk materials such as waste material, landfill, coal, etc. As such, there is no motivation for incorporating a staging unit in the top dumping container handler apparatus of Hagenbuch et al.

2. Claims 10 and 21 are rejected under 35 U.S.C. §103(a) as being obvious over Hagenbuch et al. in view of U.S. Publication No. 2002/0159865 (hereinafter, "Konstant"). Konstant is cited for disclosing a gas spring 66. The Office Action states that it would be obvious to modify the apparatus of Hagenbuch et al. to include a gas spring to improve tilting load deliveries. This rejection is respectfully traversed

The Hagenbuch et al. apparatus already includes a hydraulic cylinder actuator 188 for the controlled movement of the cradle. Unlike Applicant's pallet hopper which is manually moved and benefits from the use of a gas spring to dampen the movement of the hopper, there is no need for a gas spring in the Hagenbuch et al. apparatus. Accordingly, there is no motivation for one skilled in the art to combine the gas spring of Konstant with the apparatus of Hagenbuch et al. Moreover, Konstant does not remedy the deficiencies of Hagenbuch et al. discussed above. Even if one were to combine the teachings of Konstant and Hagenbuch et al. the present invention would neither be disclosed or suggested. Reconsideration and withdrawal of the rejection are respectfully requested.

3. Claims 22 and 24 are rejected under 35 U.S.C. §103(a) as being obvious over Hagenbuch et al. in view of U.S. Patent No. 4,037,734 (hereinafter, "Erdman"). Erdman is cited for disclosing a gate 42, gate supporting members and means 48 for raising, lowering and tilting the gate "to solve the problem of depalletizing layers of cases individually by eliminating the step of lifting and raising the entire stack." This rejection is respectfully traversed.

The Hagenbuch et al. apparatus is a top-dumping container handler. The container is locked onto a cradle and then inverted to dump the contents of the container from out of the open top. Not

only would incorporating a gate into the Hagenbuch et al. apparatus serve no purpose, it would interfere with the dumping operation. Hence, there is no motivation to combine the teachings of Erdman and Hagenbuch et al. Moreover, Erdman does not remedy the deficiencies of Hagenbuch et al. discussed above. Even if one were to combine the teachings of Erdman and Hagenbuch et al. the present invention would neither be disclosed or suggested. Reconsideration and withdrawal of the rejection are respectfully requested.

CONCLUSION

For at least the reasons stated above all of the pending claims are submitted to be in condition for allowance, the same being respectfully requested.

Respectfully submitted

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EXHIBIT 1

Four bar linkage

From Wikipedia, the free encyclopedia

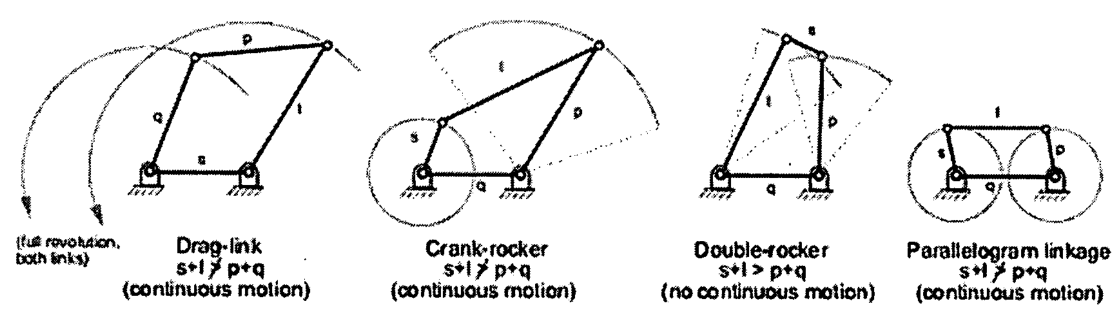
A **four bar linkage** or simply a **4-bar** or **four-bar** is the simplest movable linkage. It consists of 4 rigid bodies (called bars or links), each attached to two others by single joints or pivots to form a closed loop.

Four-bars are simple mechanisms common in mechanical engineering machine design and fall under the study of kinematics.

If each joint has one rotational degree of freedom (i.e., it is a pivot), then the mechanism is usually planar, and the 4-bar is determinate if the positions of any two bodies are known (although there may be two solutions). One body typically does not move (called the **ground link**, **fixed link**, or the **frame**), so the position of only one other body is needed to find all positions. The two links connected to the ground link are called **grounded links**. The remaining link, not directly connected to the ground link, is called the **coupler link**. In terms of mechanical action, one of the grounded links is selected to be the **input link**, i.e., the link to which an external force is applied to rotate it. The second grounded link is called the **follower link**, since its motion is completely determined by the motion of the input link.

Planar four-bar linkages perform a wide variety of motions with a few simple parts. They were also popular in the past due to the ease of calculations, prior to computers, compared to more complicated mechanisms.

Grashof's law is applied to pinned linkages and states; *The sum of the shortest and longest link of a planar four bar linkage cannot be greater than the sum of remaining two links if there is to be continuous relative motion between the links.* Below are the possible types of pinned, four-bar linkages;



Types of four bar linkages, s = shortest link, l = longest link

Notable four-bar linkages

- If the input link may rotate full 360 degrees, it is called a **crank**. The linkage is called a **crank-rocker** if the input link is a crank and the opposite link is a rocker. If the opposite link is also a crank the linkage is called a **double-crank**.
- Pantograph (four-bar, two degrees of freedom, i.e., only one pivot joint is fixed.)

- **Crank-slider**, (four bar, one degree of freedom)

Free simulators

Four-bar Linkages simulator. (Windows-only, buggy) (http://vb-fourbarsim.sourceforge.net/)

http://www.mechanisms101.com/fourbar01.html / Flash Four-bar Linkages simulator

Retrieved from "http://en.wikipedia.org/wiki/Four_bar_linkage"

Categories: Kinematics | Linkages

EXHIBIT 2

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Analysis of a Four-Bar Linkage

Objectives

The objectives of this module are to:

1. introduce the conventional notation for modeling four-bar linkages,
2. introduce the use of the Working Model program for linkage analysis by systematically "building" a four-bar linkage, and
3. reinforce the course lecture material, by providing students an opportunity to create a four-bar linkage model and evaluate it based on various criteria.

Background: The Four-Bar Linkage

The four-bar linkage is the simplest possible closed-loop mechanism, and has numerous uses in industry and for simple devices found in automobiles, toys, etc. The device gets its name from its four distinct links (or bars), as shown in Figure 1. Link 1 is the ground link (sometimes called the frame or fixed link), and is assumed to be motionless. Links 2 and 4 each rotate relative to the ground link about fixed pivots (A_0 and B_0). Link 3 is called the coupler link, and is the only link that can trace paths of arbitrary shape (because it is not rotating about a fixed pivot). Usually one of the "grounded links" (link 2 or 4) serves as the input link, which is the link which may either be turned by hand, or perhaps driven by an electric motor or a hydraulic or pneumatic cylinder. If link 2 is the input link, then link 4 is called the follower link, because its rotation merely follows the motion as determined by the input and coupler link motion. If link 2 is the input link and its possible range of motion is unlimited, it is called a crank, and the linkage is called a crank-rocker. Crank-rockers are very useful because the input link can be rotated continuously while a point on its coupler traces a closed complex curve.

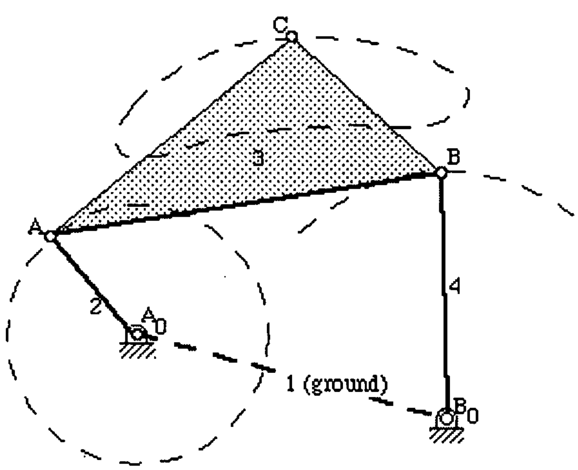

Figure 1: Four-bar linkage showing paths traced by moving pivots A and B, and coupler point C.

Assignment: Building (virtually) a four-bar linkage

A fundamental concept in modeling a linkage is the concept of critical dimensions. The kinematic performance of a linkage is determined entirely by the positions of the pivots; the shapes, sizes, material properties, etc. of the links themselves have no effect. For this reason, it is critically important to position the pivots precisely; the links can then be essentially sketched freehand. It is also very important to understand that the coordinates of the moving pivots will change as the linkage moves, and this is affected by the manner in which Working Model is used.

Before a linkage can be "constructed," the coordinates of all of the pivots (and the coupler point) must be known at some position (called the reference position). This may be determined by any graphical or analytical synthesis procedure, or for an existing linkage, may be scaled from an accurate drawing. Sometimes the known information at the outset includes the link lengths, the lengths of the sides of the coupler triangle, the choice of input link, and an indication of the *configuration* ("open" or "crossed") [Norton], but not the pivot and coupler point coordinates. In this case, a complete position analysis must be performed to determine the coordinates. With the pivot and coupler point coordinates known, the following steps result in a precise linkage model, with minimal frustration.

Step-by-step procedure for building a linkage

1. Open up a new Working Model window. Place 5 point elements anywhere on the screen to be used as a guide for sketching the links. Precisely position each point by selecting it, opening up the "properties" window, and entering its *x-y* coordinates (either local or global). Because the points are attached to the background (ground link), the local coordinates are the same as the global coordinates. Note that the angle of a point has no meaning whatsoever.

2. The links can now be sketched "freehand." It is recommended that the general polygon be used for the links rather than the rectangle. For triangular links, it is recommended that the points be "squared off" so that the link better encloses the pivot or point. Of course, if the link is a well-defined rigid body, one should make a reasonable approximation of the body's actual shape. Also, complex link geometry can be imported from a variety of programs, and converted into Working Model Objects. Depending on your specific requirements and your tolerance for frustration, you may want to turn off "grid snap" and "object snap."

3. This would probably be a good time to save your model if you haven't already done so. It is a good idea to save your changes periodically, particularly after any significant effort has been made.

4. Each "point" (attached to the background) must be replaced by either by a "pin-joint" or, for the coupler point, a "point" on the coupler link. For each point, select it by dragging around it with the pointing tool, and double click on it with the mouse button. This should change its appearance and bring it up to the "surface" (the top link). Place the new joint (or point) directly on top of the old point. It is now possible (though not really necessary) to delete the original point, since its only purpose was as a guide for sketching the links.

5. Use the "smart editor" to "physically" move the linkage by tugging on the input link, to ensure that the joints are properly defined. WARNING! Immediately following any use of the "smart editor," the linkage will be in a new position which does not correspond to your specified reference position. It is ESSENTIAL that you immediately "undo" (Edit menu) the movement.

6. Changing the position of the joints is somewhat tedious.A joint connecting two bodies consists of 2 points, one attached to each body. If you open the properties window for a joint, the coordinates shown are the local coordinates of each point, and it may not be obvious to which link each point is attached. Also, for the moving pivots, neither pair of local coordinates has any meaning. First select the joint, and note which two points form it (in the properties menu). Select the "split" tool, which removes the constraint. While in the properties menu, change the global coordinates of each point to the precise values, and then select the "join" tool. Use the "smart-editor" to confirm that the linkage works, undo the "smart edit," and save your changes.

The linkage is now complete. For many potential linkage design situations, the movability of the linkage can be demonstrated/confirmed by simply using the "smart-editor" to pull it through its range of motion (remember to always undo any "smart-edit"). However, for many other applications, it is necessary to either replace one of the ground pivots with an actuator (motor) to drive the input, or to drive one of the links (possibly the coupler) with a user defined force. This also enables the designer to generate a number of useful sets of output data and plots to demonstrate the relative quality of the motion generated by the linkage.

Applying a Rotary Input - Adding a motor

To replace a ground pivot by a motor, first delete the appropriate ground pivot, select the motor icon, and place it in the approximate location. Repeat the procedure described above for positioning it precisely (i.e., split, move each point, and join). The default motor speed of 57.296 /sec does not work well for complete rotation of the input link; some even multiple of 360 is preferable. For example, 10 seconds at 36 /sec totals 360 . Choose a negative angular velocity if you wish the input link to rotate in the opposite direction. Note: the default mode of the motor is angular velocity. It is possible to change this to torque, but it is not recommended for this purpose. Before running the simulation, select all (edit menu) and choose "do not collide" (object menu). This will ensure that the links are correctly modeled as passing in front of one another.

Applying a Translational Input - Adding a force

It is possible to drive one of the links directly with a linear force instead of a rotational motor. However, for most situations, a more useful alternative is to use a linear actuator, which can either be a force (default) or a linear velocity. After selecting the linear actuator icon, place the cursor on the link at the approximate location of the point at which you would like to apply the force. Then drag the other end to a suitable location on the background. The precise locations of the two end-points can be adjusted in the same way as for the points or joints.

Simulation/Animation of the linkage

By default, animation of the linkage does not track the movements of the links and joints (points). However, if tracking is selected (World menu), the default is to track everything. To illustrate the motion of a linkage, some limited tracking is desirable, which requires turning off tracking for each link and joint (point) in the "appearance" menu, except for those selected points (typically the coupler point, and perhaps the moving pivots) for which tracking is desired.

Simulation of the linkage will now trace the coupler curve and the range of motion the follower link. The relative spacing of the points suggests the velocity of the path tracer point, but it is possible to plot this velocity (as well as many other functions) as a function of the input crank rotation.

Displaying graphs

The "measure" menu allows the selection and display of a variety of functions, such as position, velocity, or acceleration (for points), force or torque (for joints), and a vast array of possibilities for rigid bodies. However, for analysis of linkages, it is desirable to customize Working Model output graphs (meters) to display specific linkage analysis functions such as transmission angle, angular velocity ratios (influence coefficients), locations of instantaneous centers of rotation, and mechanical advantage (static forces which can be compared to the dynamic force calculations). These specialized functions can then be used in later modules, and for student design projects. Figure 2 shows the properties and appearance menu for an example displaying the transmission angle as a function time. An unlimited variety of output functions can be displayed using this approach.

The "angle" of a link (or polygon) is very difficult to use in equations. It is defined relative to the original orientation of the link, which is likely to have no relationship whatever with its orientation after modifying it, assembling it with others, etc. Therefore, it makes sense to precisely calculate all necessary angles in terms of the *x-y* coordinates of the points, the locations of which are critical (as has already been discussed).

1. Select the coupler link (or any link for that matter), and open up a graph (select "position - all" in the "measure" menu.
2. Convert the graph from "digital" to "graph" by clicking on the upper left corner.
3. The graph in this example is called output[22]. Open up its "properties" window, and change the functional values to be plotted. The transmission angle is defined as the absolute value of the angle between the coupler link and the follower link. The angles of the coupler and follower links must be expressed in terms of the coordinates of their end-points, as shown in Figure 2. Note also that the auto boxes have been de-selected, allowing the user to precisely enter the ranges of values to be plotted.

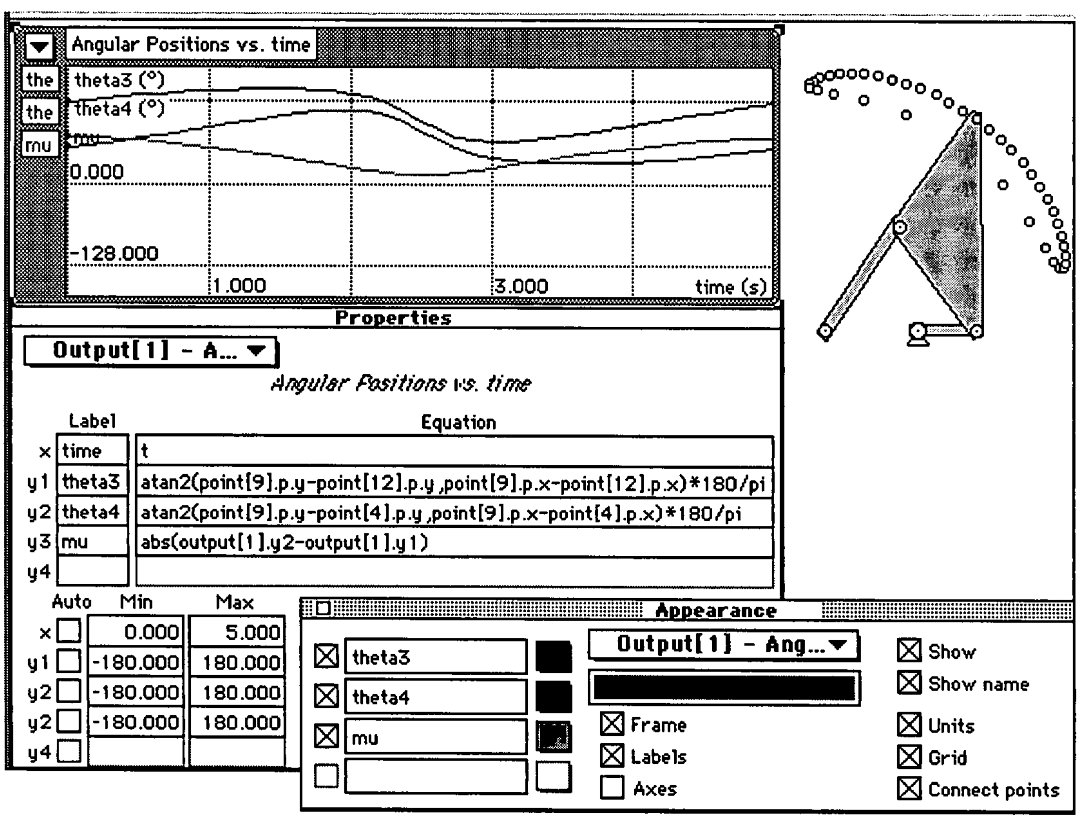

Figure 2: Properties and appearance menu for a customized output graph.

Please send any comments to Dr. Daniel Olson (olson@egr.uri.edu)

Last modified: October 7, 1996